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Myths About Older People's Use of Information and Communication Technology

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Abstract
This paper discusses six myths common in the field of 'human-computer interaction (HCI) and older people'. These myths are widespread among computer scientists, engineers and programmers, as well as among the general public and even older individuals themselves. We can define these myths as follows. (1) Just wait and see. Future generations of older people will use computers without problems. This myth differs from those following, as it may lead to a (dangerous) conclusion of avoidance and inactivity by integrating myths 2–6. If the other myths are accepted as being true and one assumes that the problems will eventually solve themselves, it might not seem worthwhile to expend any effort on 'universal design' for older people's use of information and communication technology (ICT). However, we argue that if we do not actively and properly counteract these myths, we will perpetuate them and their grave consequences. (2) Older people are not interested in using computers. They are unaware of computer capabilities. (3) Older people consider computers as useless and unnecessary. (4) Older people lack the physical capabilities to use ICT. (5) Older people simply cannot understand interactive computing technology. (6) You can't teach an old dog new tricks. The problem of HCI for older people is that they do not learn to use new technologies and interaction techniques. In discussing these myths, we demonstrate that each one contains a grain of truth. However, the myths are improperly overgeneralized and, therefore, often wrong. Such myths are problematic. Designers and engineers often accept them as truths and neglect older users and/or apply information and communication technologies in an age-discriminating manner. Furthermore, the myths are problematic as they lead older people to avoid computer usage (i.e. a self-fulfilling prophecy). We present evidence to support the notion that these myths may often be largely – although not completely – wrong. We then demonstrate how they can be counteracted through user-centered design, training and instruction.

Introduction

Geographical viewpoints always have coordinates in three dimensions. Scientific viewpoints can have several more. Therefore, it is necessary to define the coordinates of one's own position before describing what can be observed from this viewpoint. The first dimensions are the aspects which we investigate, namely 'older people' and 'information and communication technologies (ICTs)'.

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Both concepts are broad and central to understanding the overall topic. Readers of this journal are surely familiar with the vagueness of the term 'older people'. Who qualifies as 'older people'? It is well known that there are different facets of age (e.g. biological, behavioral and sociological, among others). In addition, the context determines which calendar-based age may be considered 'old' age. A world record swimmer may be 'old' at 30, while a candidate for the office of the pope may be 'young' at 70.

In this article, we must consider the context of 'computing' when specifying 'older people'. Personal computers have existed for some 20 years as a commonly used technology (i.e. used in over 50% of workplaces and households), at least in developed countries. Therefore, we can subtract approximately 20 years from the average life expectancy (75–80 years) and calculate that individuals above the age of 55 are 'older people with regard to computing'. However, we know that this lower limit is not fixed.

The term 'computing' is also vague. Regarding applications, the majority of computers are not used for computing in a literal sense (i.e. calculation), but for the retrieval of information, communication and the support of everyday tasks (e.g. shopping, reading, banking, interaction with electronic and electromechanical devices). This has also influenced the scope of this article. We have chosen a broad perspective when discussing computing, defining it as the 'use of ICT'.

There is yet another coordinate to our point of view. We focus on the *use* of computers and ICT, thereby assessing aspects of usability. One of our basic assumptions is that ICT could be extremely helpful to older people, but we recognize that there are high barriers to their usage. In this article, we will argue that many people in different positions contribute to the current unsatisfactory situation. This situation is one in which potentially beneficial ICTs are not used by older people, despite the fact that they can benefit even more from these technologies than younger people. We argue that the problems encountered by older people are generated mostly by hardware and software developers, designers and managers, as well as older people themselves.

There are many hypotheses, assumptions, beliefs, preconceptions and expectations in the field of 'human-computer interaction (HCI) and older people'. We have summarized six myths. These myths are based less on a systematic review of the scientific literature (usually myths are not explicitly discussed there) than on our experiences over the past 8 years of research in this field and on discussions with computer scientists, designers and older people. Quite explicitly, many myths can be found in mass media and advertisements and are often embodied in electronic devices specifically designed for older people. The six myths are summarized below.

(1) *Just wait and see. Future generations of older people will use computers without problems.* The problems older people have with HCI are only a temporary phenomenon. The next generation entering the 'older people' stage will possess the knowledge and skills necessary to use HCI.

(2) *Older people are not interested in using computers. They are unaware of computer capabilities.* It is not a problem of design; older people are simply not interested in using computers and completely unaware of computer capabilities. So, why bother?

(3) *Older people consider computers as useless and unnecessary.* Older people may be aware of ICT but consider computers to be useless and unnecessary for their personal lives.

(4) *Older people lack the physical capabilities to use ICT.* The problem of HCI and older people is mainly one of size (e.g. text fonts and buttons), contrast, brightness and other physical features. This problem can be solved by designing user interfaces specifically for older people.

(5) *Older people simply cannot understand interactive computing technology.* Older people lack the basic knowledge required for HCI. There is a special language used to describe computer objects and functions which is foreign to older people. The meanings of words such as 'file', 'browser', 'link', 'desktop', 'download', 'site', 'scrollbar' and 'cursor', among others, are unknown. For this reason, older people are simply unable to understand how computers work.

(6) *You can't teach an old dog new tricks.* The problem of HCI for older people is that these individuals do not learn to use new technologies and interaction techniques. They are unmotivated and not cognitively able to learn how to interact with computers.

Although these myths overlap thematically in part and cannot be easily analyzed separately, we will discuss them individually for didactic reasons. Myths such as these can sometimes contain a grain of truth. If this is the case, these grains of truth will not be ignored. However, if we take myths for granted and accept them as if they are facts, we create a reality in their image. Therefore, it is our goal to support grains of truth with facts and confront stereotypes with scientific findings and preconceptions with informed opinions.

Just Wait and See: Future Generations of Older People Will Use Computers without Problems

We begin with this myth, because it has a key function. If it were completely true (it is not), it could be argued that the following myths can be neglected, since it might not seem worthwhile to expend much effort if the resulting problems will eventually solve themselves. In that sense, it is a 'meta-myth', which can potentially lead to a (dangerous) conclusion of communal avoidance and inactivity.

One common assumption is that the difficulties older users currently have with computers are merely a temporary problem. Current seniors have not had much contact with PCs and other electronic equipment. Therefore, they have not had to learn how to use them. It seems obvious that problems should arise now when they try to use ICT. In addition, the myth implies that these problems will solve themselves, as the younger generations learn how to use developing computer systems by the time they reach old age. Occasionally, this myth is explained with the help of an analogy. Older immigrants often do not learn the language of their host countries. Their grandchildren, however, do so with success. After two or three generations, the problem has solved itself. Can this process be applied to computer use?

The myth overlooks one essential point, i.e. the progressive nature of technical development. What is contemporary and novel today may be obsolete, replaced and/or forgotten within one or two decades. Those who learned to use programs such as DOS, dBASE or Wordstar in the 1980s can no longer apply their knowledge. In particular, the development of devices such as computers, smartphones and tablets is fast-paced. Thus, the knowledge necessary to use these technologies will continue to change, which is different from the learning of foreign languages. The value of experience with formerly current technologies will decrease with age. Individuals must continuously and actively adapt to new technologies and changes in many different ways [1]. Changes are not limited to input techniques, such as the transition from mouse navigation to touch gesture navigation and from a graphical user interface to a natural user interface, but are also occurring in the language used to describe these interactions. The spoken language is not the only obstacle for communication about and understanding of modern computer technology [2]. The graphic symbols and icons used to describe operating controls and interaction surfaces also present an obstacle. Of course, older people are able to learn (see the arguments regarding myth 6) how to use new technologies which have yet to be invented. However, current knowledge will not suffice. It takes effort – increasingly with age – to acquire new interaction knowledge.

Another aspect is the unavoidable decline of perceptive, motor and cognitive skills in old age, which will occur regardless of the technical system in use. This will also influence interaction with computers, regardless of the level of expertise with and the degree of novelty of these systems. Compensating such decline continues to be a challenge for the development of future interaction techniques.

It seems that this myth is based on the assumption of a singular cohort effect which will dissolve over time. In fact, this effect is continuously renewed. The problems faced by older people today regarding the use of computers and related technology products will continue to play a role in the future. The task of getting people to use new technology remains. The specifics may change, but the core of the problem will persist [1]. The discussion of the following myths also illustrates that these difficulties can be counteracted by addressing the characteristics of older people as well as adequate technology design.

Older People Are Not Interested in Using Computers: They Are Unaware of Computer Capabilities

Nearly 30 years ago, the first studies on the interests of older people with regard to computers were published. These studies were mainly based on surveys or interview-based data collections on attitudes towards computers. Brickfield [3] demonstrated that older adults have rather negative attitudes towards computers. Similar findings were reported by several other studies. However, there were also contrasting results. Ten years later, Dyck and Smither [4] found the opposite to be true; older adults (55 years of age and over) were less computer anxious, had more positive attitudes towards computers and liked computers more than did younger adults (30 years of age and under). These results were even more surprising, as the older adults had less computing experience than did the younger adults. Computing experience is often correlated with positive attitudes towards computers. In more recent publications, we also observe inconsistent or complex results [5]. These complex findings may be explained by multiple moderator variables (e.g. gender, education, household income, definition of age group). It makes quite a differ-

ence whether computer attitudes are analyzed with age groups of '55+', '65+' or '80+'.

Another explanation for diverse findings lies in the dependent variables (e.g. emotions, attitudes, behavior) and in the operationalization of computer use. In the early years of research, computer use consisted mainly of text processing, spreadsheet calculations and database operations. These tasks were of low relevance to the everyday lives of older people and, therefore, of little interest to them.

Beginning in the mid-1990s, the purpose of computer usage changed. The Internet and its two main applications, e-mail communication and the supply of information through the World Wide Web, became increasingly interesting for older people. Most of them did not purchase computers to perform traditional computing tasks, but rather to access the Internet. This appears to be an activity in its own right rather than merely a computer task. This tendency has been strongly supported by the availability of devices that do not resemble a traditional computer. The triumph of the tablet PC, such as the iPad®, among older users is a good example of how interest can be evoked when easy-to-use hardware, well-designed software and attractive functionality/content are combined. The overwhelming acceptance of this new type of technology by all age groups clearly demonstrates that there is no need for special 'senior computers'. Again, it remains to be seen whether the gained easy access and simple-to-use interface will be offset by the integration of too many functions. This could lead to the provision of too many options and too much information. Alternatively, we may succeed in using the inspiring new technology to support older people in their daily tasks, by asking them about their needs, deriving their user requirements and creating truly useful products they can use effectively, comfortably and joyfully. With the easy access, far reach and rapid updates of todays 'app stores', older people may well have more and better choice than ever before, providing a very good chance to get what they need.

However, some trends have generated difficulties for both older and younger users. An increasing number of traditional technical devices, from light switches to automobiles, have been equipped with partly hidden microprocessors and other IT components. Although these devices still appear to be quite different from computers, they demonstrate similar behavior. Older people seem to avoid these devices as much as possible. In our own studies on the purchasing of railway tickets, we found that older travelers avoided the use of ticket vending machines (TVMs). They preferred personal counter service, even if the waiting time was much longer than at the TVM (e.g. 20 min waiting time at the counter vs. no waiting time at the TVM). We also found that younger people experience the same difficulties with TVMs as older people do. However, they can overcome usability barriers more easily and explore how a nontransparent function works. The high need for security of older people often prevents them from trying.

In summary, the reality appears to be far more complex than the myth suggests. Older people are especially interested in Internet applications but are discouraged when sophisticated computerized devices replace simpler ones which were easier to use. This brings us directly to the third myth.

Older People Consider Computers as Useless and Unnecessary

As with the other myths, this statement should not be overgeneralized. While there are some very active and engaged older computer users (the so-called 'silver surfers'), the majority of older people simply does not know how computer technology could support their everyday activities. Many older people are interested in support from computer technology but shy away from sophisticated interaction processes, in contrast to younger people. Older people seem to prefer a new type of computing which has been labeled 'calm computing' [6]. They like the benefits of using computer technology (e.g. simplification of driving and other activities) but dislike the cumbersome interaction with computers or similar devices necessary to gain such benefits.

When using computer-based interactive devices, older users have very similar requirements to those of younger users [7]. The authors carried out an ethnographic study in which 20 young (mean age 25 years) and 19 older adults (mean age 71 years) were instructed to photograph 24 interactive devices in their daily surroundings, 12 of which they liked and 12 of which they disliked. Additionally, they were to describe, using only a few words, *why* they liked or disliked the photographed device.

A content analysis of 2,493 statements regarding 929 devices revealed 8 factors influencing the general liking/disliking of interactive devices. These 8 factors can be condensed to 4, as follows: (1) utility as measured by functionality, general quality and matching of user needs (mentioned in 38% of all statements); (2) usability (i.e. ergonomic design; 32%); (3) aesthetic design and emotional

involvement (21%), and (4) cost/price (9%). While the main reason for liking interactive devices is their utility, the main reason for disliking them is poor usability.

Cum grano salis, there are more similarities in the findings for the two age groups than there are differences. The ranking mentioned above is the same for younger and older users. There are only two significant differences in the frequency of statements; namely, older adults named usability more frequently and younger adults named general quality more frequently. We interpret this result as supporting our general assumption that older users appreciate computing technologies (and products which incorporate them) if they (1) are convinced that they offer advantages to their daily lives (as do younger adults) and (2) feel that using these technologies will not be burdensome or require too much learning effort (less important for younger adults).

In summary, many studies have found that older users *do not* regard computers as useless or unnecessary. In fact, the opposite is true. The main reason for older people deciding to use a computer system is its perceived usefulness. This explains why most of them are more interested in the results of computer technology use than in the technology itself. The main reason for non-use is not the lack of perceived usefulness but rather the lack of perceived (and real) usability.

Older People Lack the Physical Capabilities to Use ICT

This myth deals with the physical (especially motor and perceptual) capabilities, rather than the cognitive and associated mental abilities, which will be addressed in myths 5 and 6. We present a short story as an introduction to the topic.

A woman in her late 70s, who participated in our research, had attended a computer course for seniors at an adult education center. She excitedly reported on what they had learned and concluded by saying, 'however, the use of the mouse was not allowed'. Instead, the seniors had learned shortcuts on the keyboard.

This myth may be partly based on empirical findings. For example, observations [8, 9] suggest that older people can encounter difficulties with some mouse operations, such as positioning the cursor. Apparently, the teacher was convinced that all older people would have great difficulties with hand-eye coordination, so he decided not to teach them how to use the mouse. Based on his generalized assumption, he taught an alternative method of interaction. This greatly impairs the ease-of-learning for every new user group, because it assumes that the knowledge of use is presented in the minds and not in the world (as presented in a graphical user interface) [10]. Perhaps the teacher's knowledge of the myth and his well-intentioned conclusion of how to counteract it resulted in an even worse form of interaction. Not surprisingly, this causes major problems, not only for older users. Sadly, this myth seems to be common both in the media and among young professionals who should know better.

Of course, this myth contains an element of truth. Undeniably, the probability of limitation of motor functions and visual acuity increases with age. Additionally, there is greater variability in older age groups than in young generations [11]. However, these potential limitations and other characteristics of the various target groups should not be counteracted with an adaptation of the human to the computer, as demonstrated in the anecdote above. Rather, the truth of the myth should be counteracted with an adaptation of the technology to the human and a design that improves the usability of the computer for every user group.

The potential for such adaptation has increased in recent years, e.g. through touch screens in many technical devices. This type of input and control is better, especially for older users [11], as it requires less effort of hand-eye coordination (i.e. mouse and cursor movement). Therefore, it is more direct than the use of a computer mouse. The steadily growing demand for tablet PCs and their ability to convince new user groups and computer skeptics demonstrates the attractiveness of this mode of operation. With these devices, it is also possible to scale font sizes (similar to Internet browsers) so that the device in its physical form is the only remaining limitation. Thus, visual impairment need not be a hurdle for the appropriate use of ICT.

In summary, it can be said that certain physical limitations may increase with age but can largely be counteracted with suitable design and an optimal combination of hardware and support. Hence, the myth that older people lack the physical capabilities to use ICT can at least be partly compensated.

Older People Simply Cannot Understand Interactive Computing Technology

ICT often seems to be too complex for older people, displaying many unnecessary functions on the surface of the user interface and hiding some necessary func-

tions away in modes and menus. It is possible that because older people may have predominantly learned to use mechanical machines (each knob corresponds to one function) in their youth, rote learning (learning step-by-step operations) seems appropriate to them, because mechanics cannot easily be changed. With multipurpose ICT, it becomes more important to understand the task structures and designers' intentions than the physics of the product. Often, when faced with ICT, older people seem to have trouble understanding the 'language' of the computer (computer literacy [12, 13]). Many of them do not know the semantics (e.g. functions and objects), the grammar (e.g. common interaction patterns) and lexicographic units (e.g. computer icons and terms).

Three more factors contribute to the lack of understanding. The first is the age-related general slowing of processing speed, which correlates with the level of impairment over a wide range of abilities [14]. The second is the decreasing ability to discriminate between relevant and irrelevant stimuli, which can lead to the remembering of irrelevant information and reduce the ability to deal with cluttered displays, for example. The last is an increased vulnerability to stereotype threat, which further decreases memory performance [15].

Screens cluttered with attention-demanding visual stimuli and multifunction buttons with different modes of operation pose a challenge, particularly for older users. Yet, most older people would be very capable of using ICT if it were not designed *by* younger people *for* younger people.

In summary, older people can understand ICT if it is designed for them as much as it is designed for younger people. ICT which cannot be understood by older people could just as well be considered as being flawed in design.

You Can't Teach an Old Dog New Tricks

This is what many people (e.g. designers, engineers, computer programmers) believe. Even older people themselves are convinced of this myth [16]. However, perhaps with humans as with dogs, new tricks can be learned if the motivation is there. We must begin by differentiating between ability and motivation.

The human brain's plasticity decreases with age. It becomes increasingly difficult to integrate new information into existing and ever-growing knowledge [17]. This does not mean that older adults are not able to learn. Many studies have demonstrated short- and long-term learning effects [18]. Older people tend to be better at remembering distant events than at remembering recent events, which can have an effect on learning to use new technologies (e.g. a new smartphone) and can contribute to a preference for familiar devices.

At the same time, the motivation to learn new things decreases, especially if no immediate need or benefit is discernible. An anecdote may illustrate this tendency.

In one of our (unpublished) interview studies on the identification of barriers for integrating the World Wide Web into teaching at schools, some teachers (aged 55+) argued that this would be more trouble than it is worth, because they will retire in a few years.

Another fact may prevent older users from learning. If they fail when they try to use an interactive program or device for the first time, the negative experience can result in avoidance strategies. Consequently, a vicious cycle can develop. People become less and less interested in exploring new technology, while the use of new technology simultaneously becomes increasingly difficult for them. This can result in reduced exposure to and experience with ICT. Consequently, there is less opportunity to acquire necessary computer literacy.

However, the effects of these processes on the use of technology by older people should not be overgeneralized, nor should they be used as an excuse to neglect design efforts on behalf of older adults. On the contrary, older people should receive special attention in regard to design and support. They are often interested in new technology (see the study of Sayago et al. [19] for an overview of everyday ICT use by older people) and can learn to use it, as has been demonstrated by numerous studies. However, learning is different in old age, and different training strategies are required than in young and middle adulthood. The provision of more guidance and the reduction of the element of 'exploration' is helpful. The learning process should always begin with a success. Therefore, simple tasks should be presented first. Software should be made to be flexible and adaptive. In the first steps of HCI, the user interface should offer only very few options.

The learning of ICT use can be facilitated by human teachers or coaches, as well as by ICT itself. Human support can be found in both private (e.g. 'grandson support hotline') and public (e.g. TVM guides) contexts. However, ICT support solutions still seem to be scarcely employed, although they have been proven by numerous studies to be effective, as outlined below.

Rogers et al. [20] demonstrated the effectiveness of online automatic teller machine training for older adults

(61–81 years of age). Bruder et al. [21] described their development of an effective, task-oriented training program for mobile phone users between 50 and 77 years of age. Struve and Wandke [22] reported results of adaptive training programs with videos to enhance TVM learning of young (20–31 years of age) and old (60–74 years of age) users. Sengpiel [13] showed that, for the same TVMs, even a brief instructional video (2:37 min) providing basic interaction knowledge, when viewed immediately prior to use, effectively reduced age differences.

It might be more difficult to convince older people to use new ICT. They might also have more difficulty learning to use it. However, as they could benefit greatly from ICT use, are generally willing to use it and able to learn it, ICT designers should be encouraged to incorporate the needs of older users in their design considerations.

Conclusion

ICTs offer vast potential to improve the quality of life of older people. However, there are barriers that are difficult to overcome. These barriers can be described as myths which affect folk psychology and public opinion. Although these myths contain a grain of truth, we argue that they are unfortunately overgeneralized, as there are many empirical studies which have revealed these myths to be completely or partly wrong. They must be confronted with facts, as myths have a tendency to be self-fulfilling and self-reinforcing. We argue that it does not suffice to wait until myths and barriers disappear by themselves. Individuals who are responsible for the development, design, introduction and marketing of ICT are responsible for creating interactive devices, the use of which can be easily learned by all age groups (e.g. through tutorial components and training procedures). Research has repeatedly demonstrated that this is a challenging but attainable goal.

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